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From WO 99/48229 a method is known for the equivalent network in optical transmission devices, whereby apart from a working signal and a protection signal, respective check-back signals are transmitted with information about the state of seizure and evaluated at the receiving end. The check-back signals are transmitted via a monitoring channel even when the useable signal is switched off. In Figure 6 of this publication a description is given of an arrangement for switching an amplifying station on or off, in which station a check-back signal as monitoring channel and a useable signal are separated into two paths using a demultiplexer. In the path of the check-back signal, the level is regenerated by means of an opto-electrical modulator, a regenerator and an electro-optical modulator. An amplifier with a subsequent level circuit-breaker is arranged in the path of the useable signal, said level circuit-breaker switching off the output signal on the amplifier if there is no useable signal. Here the regenerated check-back signal always continues to be transmitted at a low level. Provision is also made for decision logic modules, which check the presence or absence of an useable signal. Combined with a check-back signal, the transmission is re-routed to a transmission path that is not switched off and the laser in the interrupted line is switched off.

The object of the invention is to propose a method and a device that enable a check-back signal to be detected more easily independently of the useable signals.
As, when the pump source is switched off in the transmission system, the optical amplification is cancelled, the signal-to-noise ratio in the detection of the optically transmitted check-back signal is reduced correspondingly. The object of the invention is, therefore, also to ensure reliable recognition of the check-back signal even when the signal-to-noise ratio is reduced.

With regards to the method, the object is achieved using a method having the features of Patent Claim 1, and with regards to the

Claims

1. Method for detecting a check-back signal(S_{osc})in an optical transmission system for optical signals (S1, S2, ...), said method including the following method steps:
- that a constant proportion of the output in a defined frequency range of the check-back signal(S_{osc})is concentrated in as narrow-band spectral range as possible,
- that at the sending end, the check-back signal(S_{osc})is fed into the transmission system,
- that after a section of the transmission system, the check-back signal(S_{osc})is decoupled,
- that the decoupled check-back signal(S_{osc})is opto-electrically modulated, amplified and filtered to isolate the most narrow-band spectral range possible of the check-back signal(S_{osc}),
- that the output of the isolated narrow-band spectral range is determined for the detection of the check-back signal(S_{osc}).
- that the amplification of the check-back signal(S_{osc})decoupled from the transmission system is linear and as far as possible unlimited in amplitude, so that if there is a high proportion of noise, the check-back signal(S_{osc}) is still detected in the narrow-band spectral range.

2. Method according to Claim 1, characterized in that the concentration of a constant proportion of the output of the check-back signal (S_{osc}) is created on a narrow-band spectral range by evenly distributing ones and zeros from the data of the check-back signal (S_{osc}), followed by appropriate encoding.

3. Method according to Claim 2, characterized in that,

scrambling is used to evenly distribute ones and zeros from the data of the check-back signal (Sosc)and then a CMI or RZ encoding is used to create a spectral line.

4. Method according to one of the Claims 1 to 3, characterized in that, the opto-electric modulation and the amplification of the decoupled signal is provided at least for the data bandwidth (B_{osc}) of the check-back signal.

5. Method according to Claim 4, characterized in that, after the opto-electric modulation and the amplification of the decoupled signal, an additional regeneration of the check-back signal is provided.

6. Method according to Claims 1 to 5, for determining a line discontinuity in a transmission system, characterized in that, an output level (P) of the isolated narrow-band spectral range of the check-back signal (S_{osc}) is determined, in that where an output level (P) is below a preset threshold, a line discontinuity is detected in the transmission system, in that a pump source (PQ) arranged in the section of the transmission system to make the necessary amplification of the optical signals (S1, S2, ...) is switched off when the system is in operation or when the system is not in operation it remains switched off and in that if no line discontinuity is determined, the pump source (PQ) is switched on.

7. Method according to one of the Claims 1 to 5 and to Claim 6 characterized in that, check-back signals from a counter-directional or co-directional or bidirectional monitoring channel of the transmission system

are used for counter-directional or co-directional or bidirectional pumps from one or several pump sources (PQ)for transmission direction

8. Method for measuring the transmission attenuation, according to one of the Claims 1 to 5,
characterized in that,
the output level (P) of the isolated narrow-band spectral range of the check-back signal (S_{osc})
is determined,
in that a value (G) of an amplification following the opto-electric modulation is determined and
in that by delivering the output level (P) and the value (G) of the amplification, the transmission attenuation is measured at an additional evaluation unit.

9. Arrangement for implementing the above method according to one of the Claims 1 to 5 and 6 to 8, with an optical waveguide (LWL) for transmitting optical signals (S1, S2, ...),
characterized in that,
in a first section of the optical waveguide (LWL), a first coupler (K1) is arranged to couple a check-back signal (S_{osc}), to which coupler an encoding module(COD)is connected in series for concentrating a constant proportion of the output of check-back signal(S_{osc}) in as narrow-band spectral range as possible,
in that, in a further section of the optical waveguide (LWL), a decoupler (K3)is placed to bifurcate the check-back signal (S_{osc}) from the optical waveguide (LWL),
in that the decoupled check-back signal (S_{osc}) is directed via an opto-electric modulator(OE) and further via a gain controller (AGC) to a narrow-band band-pass filter (BP) for isolating the narrow-band spectral range of the decoupled check-back signal (Sosc) and
in that a measuring module (MEAS) is subsequent to the band-pass filter (BP).

10. Arrangement for implementing the above named method according to one of the Claims 6 or 7,
characterized in that,
a first coupler (Kl) for coupling a check-back signal (S_{osc}) is arranged in a first section of the optical waveguides (LWL), to which coupler an encoding module(COD) is connected in series to concentrate a constant proportion of the output of the check-back signal (S_{osc}) in as narrow-band spectral range as possible,
in that, in a further section of the optical waveguide (LWL)there is placed a decoupler (K3) for bifurcating the check-back signal (S_{osc}) from the optical waveguide (LWL), in that the decoupled check-back signal (S_{osc}) is fed to a narrow-band band-pass filter (BP) for isolating the narrow-band spectral range of the decoupled check-back signal (S_{osc}) via an opto electric modulator(OE) and further via a gain controller (AGC) and
in that measuring module (MEAS) is subsequent to the band-pass filter (BP),
in that at least a second coupler (K2) for feeding in at least one pump signal from a pump source (PQ) is connected in series to the decoupler (K3),
in that the measuring module (MEAS) has an amplifier and a rectifier for determining an output level (P) after at least two gauge readings from the isolated narrow-band spectral range and
in that subsequently a threshold detector (CONTROL)is connected to the rectifier, and the output signal of the threshold detector is directed to a switch (ON/OFF) for switching the pump signals of the pump source (PQ) on or off.

11. Arrangement for implementing the above named method according to Claim 8,
characterized in that,
a first coupler (Kl) for coupling a check-back signal (S_{osc}) is placed in a first section of the optical waveguide (LWL), to which coupler an encoding module(COD)is connected in series for

concentrating a constant proportion of the output of the check-back signal (Sosc) in as narrow-band spectral range as possible, in that a decoupler (K3) for bifurcating the check-back signal (S_{osc}) from the optical waveguide (LWL) is placed in a further section of the optical waveguides (LWL), in that the decoupled check-back signal (S_{osc})is directed via an opto-electric modulator (OE) and onwards via a gain controller (AGC) to a narrow-band band-pass filter (BP) for isolating the narrow-band spectral range of the decoupled check-back signal (S_{osc}) and in that there is a measuring module (MEAS) subsequent to the band-pass filter (BP), in that the measuring module (MEAS) has an amplifier and a rectifier for determining the output level (P) of the isolated narrow-band spectral range and in that signals (RS1, RS2) are emitted by the measuring module (MEAS) and by the gain controller (AGC) to an evaluation unit (PROC) for measuring the transmission attenuation using the determined value of the output level (P) and the set amplification value (G) in the gain controller (AGC).

12. Arrangement according to one of the Claims 9 to 11, characterized in that, a regenerator (REG) with subsequent decoding module (DECOD) with descrambler is attached to an exit of the gain controller (AGC) to regenerate the decoupled signal(S_{osc}).

13. Arrangement according to Claim 12, characterized in that, a coupler (K4) is placed in a further section of the optical waveguide LWL) for feeding in the regenerated decoupled signal (S_{osc}).

14. Arrangement according to one of the Claims 9 to 13, characterized in that, the components (BP, MEAS) can be integrated in one or several decoupling lines (K3, OE, AGC, REG, K4) of a monitoring channel (OSC) with check-back signal (S_{osc}) used for network management, whereby, on the one hand, encoding module(COD) is connected in series to the coupler (K1) placed in the transmission system at the sending end and, on the other hand, the regenerator (REG) is connected in series to the decoding module(DECOD).

15. Arrangement according to one of the Claims 9 to 14, characterized in that, the narrow-band spectral range has 50% of the total output of the check-back signal (S_{osc}) issuing from the encoding module(COD).

16. Arrangement according to one of the Claims 9 to 15, characterized in that, The output level (P) can be detected or determined when the pump source (PQ) arranged in the optical waveguide (LWL) whether said pump source is switched on or off.